

**Independent Oversight  
Lessons Learned from Targeted Reviews  
of Implementation Verification Review Processes  
at Department of Energy  
Nuclear Facilities**



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**Office of Safety and Emergency Management Evaluations  
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## Acronyms

CFR	Code of Federal Regulations
CRAD	Criteria, Review and Approach Document
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
FR	Facility Representative
HSS	Office of Health, Safety and Security
IVR	Implementation Verification Review
NNSA	National Nuclear Security Administration
ORR	Operational Readiness Review
SAC	Specific Administrative Control
SSC	Structure, System, or Component
SSO	Safety System Oversight
TSR	Technical Safety Requirement

## **EXECUTIVE SUMMARY**

The Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security, periodically performs targeted reviews of areas of specific interest. Independent Oversight selected implementation verification review (IVR) processes as an area for targeted review to determine the effectiveness of implementation of the U.S. Department of Energy (DOE) guidance for performing IVRs that was promulgated in November 2010. This report summarizes and analyzes the results of independent reviews of IVR and associated processes at eight DOE sites conducted by Independent Oversight from August 2011 to September 2012. The purpose of the Independent Oversight review was to evaluate the processes and methods used for verifying the implementation of safety basis hazard controls and periodically re-verifying that the controls remain in place.

All contractors at the sites reviewed have established formal processes for implementing safety basis changes, and most include an IVR as an integral part of the implementation process for safety bases. The contractors that conduct IVRs have processes in place to ensure that IVR reviewers are independent of the responsible line management, although the degree of independence varies from site to site and sometimes within a site. At nearly all of the sites, the IVR procedures establish adequate expectations for an effective process. In most cases, verification methods adequately address the implementation of the safety basis hazard controls, including structures, systems, or components and specific administrative controls (SACs), though it was noted that design features are not always independently verified.

Independent Oversight found that periodic re-verification of the status of safety basis hazard controls was performed inconsistently across the DOE/National Nuclear Security Administration sites sampled during the review. Most site contractors have programs and processes in place that at least partially re-verify safety basis hazard controls on a periodic basis, though there is often not a system in place to monitor the status of re-verification. For example, all of the contractors have implemented system engineer programs, some sites accomplish some periodic re-verification through the site's functional assessment process, and several sites schedule and conduct assessments of SAC implementation. Design features are infrequently addressed in re-verification processes.

Site office oversight of the implementation of safety basis hazard controls is accomplished through a combination of methods. All but two of the reviewed site offices have procedures and processes governing oversight of safety basis implementation. The IVR process is generally included in the safety basis oversight procedure, and the process typically includes oversight of the contractor safety basis implementation. Nearly all of the site offices have participated by shadowing some of the contractor IVRs, but the site offices have not consistently conducted their own independent IVRs or evaluations of the contractor IVR programs.

Although several site offices do not specifically address re-verification of safety basis hazard controls in their procedures, Independent Oversight noted that most site offices perform some re-verification activities through routine Facility Representative (FR) oversight and reviews conducted by the safety system oversight (SSO) engineers. A number of the site offices have completed reviews of SAC implementation. The SSO engineers provide oversight of active vital safety systems (and some SSO engineers include design features in their oversight), and FRs monitor implementation of hazard controls. Although these activities are extensive, they do not systematically determine whether all safety basis hazard controls remain in place.

All of the contractor IVRs and readiness reviews observed by Independent Oversight were conducted by teams that were independent of the responsible line management and used appropriate implementation plans. The degree of rigor applied to the assessments was sufficient; team members were observed to be thorough and critical, and demonstrated adequate technical expertise and qualifications. On the whole,

the teams adequately verified that the safety basis hazard controls could be effectively implemented. The reviews were documented sufficiently, and conclusions were supported by detailed write-ups. Reflecting both the maturity of the processes and the diligence of the teams, each of the review teams identified deficiencies that were evaluated and categorized using the applicable procedures. Generally, the evidence shows that the independent review groups provide value in ensuring that safety basis hazard controls are adequately implemented.

Appropriately, the focus of the contractor readiness reviews was primarily on the readiness of the operators to perform the new activities, although the reviews also addressed (to some degree) readiness to implement associated safety basis hazard controls. Generally, the scheduled performance demonstrations were weighted toward the new operational activities, and fewer evolutions were scheduled to observe performance of surveillance and in-service tests. At some sites, a complete IVR (with full validation of safety basis hazard controls) was not performed in preparation for the readiness review. Consequently, some sites may not have placed sufficient emphasis on observation of safety basis hazard control implementation.

All of the DOE site office readiness reviews observed by Independent Oversight used adequate implementation plans with appropriate sets of criteria or lines of inquiry. The review team members were sufficiently independent of responsible DOE line management and had adequate technical expertise for their assignments. The teams placed sufficient emphasis on observations of performance. Overall, the DOE readiness review teams adequately executed their implementation plans and provided critical assessments of the previous reviews and contractors' readiness to proceed with operations, although in one instance, the sample of surveillance test observations used to verify implementation of safety basis hazard controls should have been increased.

To support DOE efforts to improve the IVR programs and ensure fully effective implementation of safety basis hazard controls, this report identifies a number of best practices and recommended actions for consideration by DOE line management and site contractors. The best practices in Section 3 include: establishing procedures for re-verifying safety basis hazard controls, using personnel from independent functional groups to conduct IVRs, using performance demonstrations, including IVR requirements in site contracts or other directives, and tracking performance of IVR activities. Recommended actions include: clarifying the expectations for site offices and contractors for performing initial IVRs and re-verification of safety basis hazard controls; establishing site office expectations for conducting independent initial IVRs, re-verifying safety basis hazard controls, and conducting coordinated reviews of contractor IVR programs; emphasizing and expanding the use of performance demonstrations to evaluate the implementation of safety basis hazard controls; and upgrading site contractor programs through expanded use of independent reviewers and improved performance of re-verifications.

Overall, Independent Oversight found that contractors have adequately implemented the guidance for conducting independent IVRs. In particular, IVRs that are conducted by experienced personnel who are independent of line management and IVRs that emphasize observation of performance were found to provide value in ensuring that safety basis hazard controls are implemented. Nonetheless, some opportunities for improvement exist, especially in the re-verification of controls. Independent Oversight also found that site offices have implemented most aspects of the IVR programs and that FR and SSO activities provide important feedback concerning hazard control implementation. However, site office oversight processes do not always support systematic evaluation of the contractor IVR programs. The weaknesses in IVR program implementation warrant management attention to ensure that the processes continue to improve and mature. DOE Headquarters and program offices should ensure that the expectations for contractor IVR programs and site office oversight of those programs (such as the guidance in DOE Guide 226.1-2) are clearly communicated.

**Independent Oversight Lessons Learned from Targeted Reviews  
of Implementation Verification Review Processes  
at Department of Energy Nuclear Facilities**

## **1.0 INTRODUCTION**

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), periodically reviews specific areas of interest at DOE nuclear facilities. Independent Oversight targets these reviews at aspects of safety programs that have been found to warrant increased management attention based on reviews of past performance data, inspection results, and operating experience across DOE sites. Independent Oversight selected implementation verification review (IVR) processes for evaluation to determine the effectiveness of implementation of the DOE guidance for performing IVRs that was promulgated in November 2010. This guidance was incorporated in DOE Guide 423.1-1A, *Implementation Guide for Use in Developing Technical Safety Requirements*, Appendix D, *Performance of Implementation Verification Reviews (IVRs) of Safety Basis Controls*. The reviews were also intended to affirm the adequacy and consistency of IVR processes at the selected sites.

In February 2008, the Defense Nuclear Facilities Safety Board requested that DOE evaluate the need to conduct “independent validations on a recurring basis” to ensure that facility equipment, procedures, and personnel training related to safety basis hazard controls have not degraded over time. In response, the Department conducted an evaluation that led to the conclusion that the existing requirements for implementation of safety basis hazard controls and DOE policy for oversight of the implementation of nuclear safety requirements were appropriate. However, the evaluation also concluded that Departmental directives contained no explicit requirement to validate safety basis hazard controls, so the Department committed to develop guidance on the validation of safety basis hazard controls and to add that guidance to its directives.

A DOE working group developed a “best practices guide” for the independent verification of safety basis hazard controls. After a period of evaluation, the guidance for performing IVRs was incorporated in a revision to DOE Guide 423.1-1A (Appendix D). DOE Guide 226.1-2, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, which includes guidance for DOE line management oversight of technical safety requirement (TSR) implementation and safety system operability, was issued in June 2012.

### **1.1 Report Scope**

This report documents the independent review of the IVR and similar processes at DOE sites with hazard category 1, 2, and 3 facilities based on a representative number of site reviews conducted by Independent Oversight from August 2011 to September 2012. The overall purpose of the Independent Oversight review was to evaluate the processes and methods used for verifying the implementation of new or substantially revised safety basis hazard controls and periodically re-verifying these controls. The reviews were conducted at 8 sites and involved 12 site contractors and 11 DOE site offices (some sites have multiple contractors and site offices). The sites and the responsible Headquarters program offices are listed in Table 1 below.

**Table 1. Sites and Program Offices in the Review**

Review Site	Headquarters Program Office	Site Office
Argonne National Laboratory	Office of Science	Argonne Site Office
Hanford Site	Office of Environmental Management	Richland Operations Office
Idaho Site	Office of Environmental Management; Office of Nuclear Energy	Idaho Operations Office
Los Alamos National Laboratory	National Nuclear Security Administration	Los Alamos Field Office
Nevada National Security Site	National Nuclear Security Administration	Nevada Field Office
Oak Ridge Reservation	Office of Environmental Management; National Nuclear Security Administration; Office of Science	Oak Ridge National Laboratory Site Office; Y-12 Field Office; Oak Ridge Office of Environmental Management
Pantex Plant	National Nuclear Security Administration	Pantex Field Office
Savannah River Site	Office of Environmental Management; National Nuclear Security Administration	Savannah River Operations Office; Savannah River Field Office

The IVR reviews focused on the adequacy and execution of institutional IVR programs and similar processes by both the responsible site contractors and their respective site offices. For all of the reviews, Independent Oversight assessed the establishment and execution of site contractor processes and activities for verifying the implementation of changes to safety basis hazard controls. The reviews also examined processes that are similar to or could incorporate IVRs. In addition, the reviews included the procedures, processes, and activities for ensuring that once established, the safety basis hazard controls are properly maintained. At most sites, Independent Oversight also evaluated the site office processes and oversight activities for verifying the implementation of changes to safety basis hazard controls. This scope was consistent with completion of objectives 1 and 2 in the HSS Criteria, Review and Approach Document (CRAD) 45-39, Rev. 1, *Implementation Verification Review of Safety Basis Hazard Controls: Inspection Criteria, Activities, and Lines of Inquiry* (posted on the Independent Oversight website at [http://www.hss.doe.gov/indepoversight/safety\\_emergencymgt/guidance.html](http://www.hss.doe.gov/indepoversight/safety_emergencymgt/guidance.html)) and was used to determine whether site contractors and site offices had:

- Established processes that provide assurance that safety basis hazard controls are maintained, and that hazard control changes are correctly implemented.
- Developed and implemented adequate methods for performing IVRs or similar reviews.

The programmatic reviews were accomplished by studying the documentation that established and governed the site contractor and site office IVR (and similar) processes (for example, work instructions, procedures, forms, and checklists) and interviewing key personnel responsible for developing and executing the associated practices. Additionally, examples of completed documentation (e.g., IVR reports and implementation plans) were reviewed to determine conformance with the established processes.

Whenever feasible, Independent Oversight also conducted performance-based reviews of the implementation of the IVR processes. This part of the review was accomplished by observing or

shadowing the site contractor and/or site office personnel during the performance of an IVR or a process similar to an IVR, such as a readiness assessment or operational readiness review (ORR). During the period of the targeted review, Independent Oversight observed four IVRs, three readiness assessments, a site contractor ORR, and a DOE ORR. The objective of these Independent Oversight reviews was to determine whether the site contractor and, in some cases, site office reviews adequately verified implementation of the revised safety basis hazard controls. The evaluation of the effectiveness of the IVR or readiness review was based in part on objectives 3 through 6 of HSS CRAD 45-39 and sought to determine whether the implemented IVR process adequately evaluated the implementation of safety basis hazard controls through review of:

- Implementation of administrative and operational procedures governing safety basis hazard controls
- Methods for verifying that safety structures, systems, or components (SSCs) and design features are installed, inspected, and maintained as described in the safety basis documentation
- Implementation of specific administrative controls (SACs)
- Processes to ensure that facility personnel are adequately trained and qualified to implement and maintain the safety basis hazard controls.

## **1.2 Requirements and Guidance**

Subpart B of 10 Code of Federal Regulations (CFR) 830.201, *Performance of Work*, states, “A contractor must perform work in accordance with the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility and, in particular, with the hazard controls that ensure adequate protection of workers, the public, and the environment.” Further, 10 CFR 830.204 requires that the contractor derive the hazard controls necessary to protect the public, workers, and environment; maintain the hazard controls current at all times; and control their use. In addition, 10 CFR 830, Subpart A, *Quality Assurance Requirements*, requirements for conducting activities that may affect safety at these facilities include: performing work in accordance with hazard controls, using approved instructions or procedures, training and qualifying personnel, conducting tests and inspections of items and processes, and independently assessing the adequacy of work performance.

The guidance captured in DOE Guide 423.1-1A, Appendix D, describes approaches for performing independent IVRs for all controls designed to implement the safety basis, e.g., TSRs and documented safety analysis (DSA) assumptions and commitments, including verification of their initial implementation, verification following changes to the safety basis, and periodic re-verification. Appendix D of DOE Guide 423.1-1A applies to all hazard controls identified in TSRs and DSA assumptions and commitments for the hazard category 1, 2, and 3 nuclear facilities, including design features, safety SSCs, SACs, and associated major input assumptions for the safety basis. The scope of the appendix includes initial verification of safety basis hazard controls for new DSAs and DSA revisions (both major and minor), as well as periodic review of the continued effective implementation of the controls.

## **2.0 OVERALL ASSESSMENT**

### **2.1 Site Contractor Processes for Initial Verification of Safety Basis Hazard Controls**

**Statement:** DOE Guide 423.1-1A, Appendix D, provides guidance for establishing and conducting an IVR program to “independently confirm the proper implementation of new or revised safety basis controls.”

**Discussion:** All of the site contractors have established formal processes for implementing safety basis changes. Many of the sites use a checklist or implementation plan that is executed by line management. At some sites, the implementation is effectively supported by databases that link the safety basis hazard control requirements to the implementing documents, helping to identify the affected documents. At other sites, the safety basis implementation process requires identification of the affected documents in developing the plan or checklist.

Most of the contractors include an IVR as an integral part of the implementation process for safety bases and their revisions. A number of contractors have established a firm requirement for completion of an IVR (or equivalent) during implementation of a safety basis change, while several others provide guidance for conducting an IVR without establishing a firm requirement. For example, one contractor requires an IVR “as appropriate,” and a second contractor requires independent verification that the implementation plan was complete without requiring implementation verification. Only one contractor had not established requirements or guidance for an IVR as part of the implementation process.

All of the site contractors that perform IVRs have processes in place to ensure that the reviewers are independent of the line management responsible for the facility that is implementing the change. The degree of independence varies both from site to site and within a site, ranging from IVR team members selected from the line organization who are not in the facility chain of command to team members from a separate and independent functional organization.

At nearly all of the sites, the procedures for planning and executing the IVRs establish adequate expectations to support an effective process. IVR procedures include sufficient instructions to guide planning, execution, and reporting, including proper classification of identified issues. The planning processes often include development of a formal plan, a plan of action, and/or an implementation plan. The processes typically allow for appropriate grading of the review. For major changes, the IVR procedures generally require the use of objectives, criteria, and/or lines of inquiry for conducting the review, and for minor changes, several of the site contractors have developed appropriate checklists to guide the review process. For sites that have conditions of approval in the safety evaluation reports, verification of implementation of the conditions of approval is appropriately included in the IVR activities. One contractor had not published detailed expectations for the planning and implementation of IVRs, and another contractor recommended only that an independent reviewer verify that the safety basis implementation plan was completed.

In most cases, verification methods adequately address the implementation of the safety basis hazard controls, including SSCs and SACs. Several sites use the CRADs from DOE Guide 423.1-1A to develop the IVR plan and conduct the review. It was noted that one site did not necessarily verify implementation of in-service inspections of design features, but rather verified entry of the design feature into the structural integrity program. A second site did not include guidance for verifying SAC implementation in its IVR procedure.

All of the contractors have adequate startup procedures and processes that are sufficiently well defined to include verification of safety basis hazard control implementation as part of the startup or restart process. Only one of the sites has incorporated the IVR process into the startup preparation process, by including an IVR as a prerequisite to the readiness review and allowing the scope of the following readiness review to be adjusted accordingly (as allowed in the DOE order and standard for readiness reviews). A majority of the sites had not fully incorporated the most recent revisions to the DOE startup and restart order and accompanying standard (DOE Order 425.1D and DOE-STD-3006), which addresses the use of an IVR as part of the line management process for achieving readiness.

**Analysis:** Although most of the site contractors include an IVR as an integral part of the implementation process for safety bases, not all of the contractors have made an IVR a firm commitment. And, while site contractors have processes to ensure that the reviewers are independent of the facility line management responsible for implementing the change, the degree of independence of the reviewers varies considerably. Only one of the sites has incorporated the IVR process into the preparations for achieving readiness in the startup process.

**Recommended Actions:** To improve the IVR process, site contractors should document and implement an IVR program and expand the use of independent reviewers, whenever practicable. This includes establishing a firm requirement to conduct a functionally independent (from responsible line management) review of all significant safety basis hazard control changes. When independent reviews are optional or graded, site contractors should conduct periodic self-assessments to determine whether appropriate independent reviews are being conducted. Finally, site contractors should further strengthen the startup process by requiring an IVR before declaring readiness to operate prior to a readiness review.

## **2.2 Site Contractor Processes for Periodic Re-verification of Safety Basis Hazard Controls**

**Statement:** Per DOE Guide 423.1-1, re-verification of safety basis hazard controls is an important tool for contractor use in ensuring that their facilities continue to operate in accordance with the safety basis. Re-verification of hazard controls should be performed every three to five years as part of the contractor's ongoing assessment. The guide includes a discussion of factors to consider in establishing the periodicity for re-verification, stating, for example, that hazard controls that are susceptible to the effects of the degradation of human knowledge (e.g., procedural controls) typically should be re-verified at least every three years and safety significant hardware-related controls typically re-verified at least every five years.

**Discussion:** Independent Oversight found that re-verification of the implementation of safety basis hazard controls was performed inconsistently throughout the Department. Only four contractors were found to have specific, formal programs and/or processes to re-verify that safety basis hazard controls remain in place; three of these contractors included re-verification in their IVR procedures. Of these contractors, one had established a requirement to perform a re-baseline of hazard control implementation every three to five years; another contractor established a requirement to re-verify safety basis hazard controls on a specified periodicity (every three years for safety class controls, every five years for safety significant controls, and every five years for safety management programs), but without addressing SACs; a third had established a requirement to verify safety basis hazard controls every five years through a sampling process and had conducted independent assessments of TSR implementation; and the fourth used an independent group to conduct an assessment of one TSR at each facility every year. Finally, another contractor is in the process of verifying all of the safety basis hazard controls by reviewing 20 percent of the controls each year as part of the site management assessment (contractor assurance) process. Some of the procedures only addressed certain types of controls (for example, one addressed SSCs but not SACs, and another addressed only SACs). In general, the design features are not addressed as part of the re-verification process.

In addition to the above, most site contractors have programs and processes in place that at least partially re-verify safety basis hazard controls on a periodic basis, and a few have a formal tracking system in place to systematically monitor the status of re-verification. The contractors in the sample have implemented cognizant system engineer programs for their vital safety systems and conducted reviews of those systems under those programs. Additionally, some sites address re-verification through the site's functional assessment process. Vital safety system reviews are conducted in accordance with the system engineering program, through which some of the safety basis hazard controls are re-verified.

Several sites schedule and conduct assessments of SAC implementation, including an annual review of the SACs and linking document database by one contractor, and an annual effectiveness review of SACs by another contractor. Another site contractor conducts independent assessments of safety system performance, but does not have an overall schedule to periodically verify or re-verify the implementation of the safety basis hazard controls in the TSRs, such as SACs and design features. Independent Oversight found that contractors use a wide range of approaches in the re-verification of SAC implementation. For example, two contractors require annual effectiveness reviews of SACs, and another contractor re-verifies SAC implementation every three years. A fourth contractor was in the process of verifying implementation of all of the SACs over a five-year period. Further, three contractors confirm implementation of SACs by periodically evaluating samples of the SACs. Finally, one contractor had not completed a recent assessment of SAC implementation.

Design features are infrequently addressed in re-verification processes; however, it was noted that one contractor addressed all TSR controls, including design features, in its master assessment schedule, and another contractor included design features in some of their facility evaluations.

In all cases, Independent Oversight found that the discussion of the review activities in the contractor reports was sufficient to provide an understanding of the review approaches and to validate the conclusions and findings of the reviewers. At most sites, the reports also provide evidence that reviews are detailed and critical, and consistently identify items requiring correction by facility personnel.

**Analysis:** Independent Oversight found that site contractor re-verification of safety basis hazard control implementation was inconsistently accomplished, and only four contractors were found to have specific, formal programs in place. Nonetheless, most site contractors have other programs and processes that monitor vital safety system performance and re-verify SAC implementation. However, not all vital safety system reviews re-verify the safety basis hazard controls, and SAC reviews vary widely in their approaches. Further, design features are infrequently addressed in re-verification processes. Although a few contractors have a formal system in place to monitor the status of re-verification, most do not take a systematic approach to tracking re-verification activities.

**Recommended Actions:** To ensure that safety basis hazard controls remain in place over time, site contractors should improve the existing processes that re-verify safety basis hazard controls. To accomplish this, site contractors should establish and execute a structured, integrated process for re-verification activities and assessments so that all safety basis hazard controls are periodically addressed. The process should include an overall schedule for periodic re-verification that SSCs, design features, and SACs remain in place. In order to improve awareness of safety basis hazard control re-verification efforts, the process should incorporate formal tracking and reporting of the status of re-verification. A matrix of credited SACs, limiting conditions for operation, and TSRs to guide the process and monitor the status of re-verification would facilitate re-verification.

### **2.3 Site Contractor Performance of IVRs or Similar Activities**

**Statement:** DOE Guide 423.1-1 provides guidance for planning and conducting IVRs, including instructions for development of formal IVR plans, selection of team leaders and team members, and detailed methods for verifying design features, safety systems, and procedures. The guide also provides examples of forms that may be used to document the results of the IVR.

**Discussion:** Independent Oversight observed the performance of four IVRs (including one conducted by the Office of Science that involved a readiness assessment for verification in lieu of an IVR) and four readiness reviews. Although the readiness reviews were not specifically performed as IVRs, these reviews assessed implementation of safety basis hazard controls in a process that is similar to an IVR

process. Independent Oversight also conducted a review at one site to follow up on questions raised by a site office review of the contractor's implementation of hazard controls at one facility. As noted previously, Independent Oversight's observations were based on objectives 3 through 6 of HSS CRAD 45-39.

All of the observed IVRs were conducted by teams that were independent of the responsible line management. The subject matter experts on the IVR teams, who were assigned appropriate subject areas based on their experience and expertise, performed the reviews with sufficient rigor and technical inquisitiveness. Two reviews were conducted under the auspices of an independent readiness assurance group, one by a team from a contracted consulting company, and another by an independent internal oversight group.

The teams executed the IVRs using appropriately detailed implementation plans. These plans adequately discussed the scope and depth of the reviews and included objectives, criteria, and/or lines of inquiry that were appropriately tailored to the safety basis revisions. The implementation plans provided suitable scope, level, and detail to satisfactorily accomplish the verification. Generally, the IVRs included facility walkthroughs, document reviews, interviews, and performance demonstrations. In one instance, the IVR also included an informal drill (targeted to a specific document change) and a group interview. Although some improvements could be made to ensure a sufficient number of evolutions are planned before the start of the IVR (in two cases, the number of observed evolutions was increased during the performance of the IVR), the teams placed sufficient emphasis on observation of performance demonstrations, including operational and work activities, and team members were properly prepared for interviews, walkdowns, and performance demonstrations. The performance demonstrations provided good feedback on the technical adequacy of the facility procedures and the effectiveness of the facility's training on the recent changes.

Similar to the IVRs, all of the readiness reviews observed by Independent Oversight were conducted by teams made up either of contractor or contracted personnel, who were independent of the facility line management. Independent Oversight observed two readiness assessments that were conducted for startup of moderately complicated activities. Independent Oversight also observed an ORR conducted by the site contractor for the startup of a major new facility for treating high activity waste.

The readiness assessments were conducted in accordance with plans of action and/or implementation plans that (based on the new activities and associated safety basis changes) contained an adequate scope for the review. The readiness assessments used criteria, objectives, and/or lines of inquiry that were appropriately tailored to the changes and included sufficient verification methods to adequately address the implementation of hazard controls and conditions of approval. The assessments were executed in accordance with the assessment plans and included document reviews, interviews, and observation of evolutions; in particular, the teams observed performance of the most significant new operational activities (including operational safety basis controls). The implementation plans also appropriately addressed the training that was provided to the facility personnel in preparation for implementing the new activities and the associated safety basis hazard controls. The degree of rigor applied to the assessments was sufficient; team members were observed to be thorough, inquisitive, and critical, and demonstrated adequate technical expertise and qualifications. Overall, the reviews were systematic and questioning, and each review identified deficiencies requiring follow-up. The readiness assessments were adequately documented with results and conclusions clearly supported by the detailed write-ups. However, in one case, the DOE assessment team appropriately directed the contractor to reclassify some findings from the contractor readiness assessment to ensure that corrective actions were given appropriate priority.

Independent Oversight also observed the conduct of the contractor ORR for startup of a new waste processing facility. The contractor ORR was performed by an experienced, critical team using an

approved plan of action and implementation plan. In addition to an extensive set of document reviews and interviews, the contractor ORR team members observed a significant number of performance demonstrations (which included operational safety basis controls), and were well prepared to evaluate the observed evolutions. The degree of rigor applied to the contractor ORR was appropriate for the initial startup of a one-of-a-kind process, and the assessment results were properly documented in both a detailed briefing and final report. The findings and recommendations were well documented, and for the most part, designation of findings was adequately justified. However, the contractor ORR implementation plan included only a small sample of the important maintenance and surveillance tests for the significant safety systems. The contractor had completed a verification that the safety basis implementation plan was complete, and a management self-assessment was performed in preparation for the contractor ORR; however, the contractor ORR pre-start findings indicated that implementation of the safety basis hazard controls was not yet complete at the time that the contractor ORR began, and the contractor ORR scope was not expanded to address additional safety systems.

**Analysis:** On the whole, the teams adequately verified that the hazard controls required by the safety bases and revised TSRs could be effectively implemented, and the teams clearly identified deficiencies requiring correction. Overall, the identified issues were properly evaluated and categorized using the applicable procedures. The IVR results were properly documented, the teams' conclusions were appropriate, and the final reports provide adequate records of the conduct of the reviews. In each case, the sites demonstrated a suitable process for ensuring that implementation of safety basis changes is complete through application of safety basis implementation plans and independent IVRs. Generally, the evidence shows that the independent review groups provide value in ensuring that safety basis hazard controls are implemented. The groups consistently identify pre-implementation or pre-start findings and issues related to execution of the safety basis hazard controls. In one instance, in which the independent group had not conducted a review of the implementation of a major revision to the safety basis at a facility, a follow-up review by Independent Oversight identified a significant number of deficiencies.

Overall, the readiness reviews were conducted in a thorough, professional manner. Appropriately, the focus of the reviews was primarily on the readiness of the operators to perform the new activities (including operational safety basis controls); however, the result of this operational (as opposed to an IVR) focus was a noticeable variation from site to site in the number and scope of observed performance demonstrations. Generally, the scheduled performance demonstrations were weighted toward operational activities, and fewer numbers of evolutions were scheduled to observe performance of surveillance and in-service tests and ensure that the facility would be operated within the new or revised safety basis. Consequently, some sites may not have placed sufficient emphasis on observation of safety basis hazard control implementation. Only one of the sites had completed a full, independent IVR in preparation for the readiness review. As noted previously, most sites had not yet fully incorporated the changes to the startup and restart order (and standard) and included the IVR process with the startup and restart processes.

**Recommended Actions:** Site contractors should ensure that IVRs are performed as part of the preparatory activities to demonstrate readiness. Site contractors should also expand and emphasize the use of performance demonstrations to evaluate readiness to implement safety basis hazard controls. Implementation plans and pre-planning activities for the reviews should ensure that a representative number of performance demonstrations for activities that implement safety basis hazard controls are included. When sampling is used as part of the review, site procedures and review teams should ensure that the scope of the review is appropriately based on previous activities, such as the IVR and management self-assessment, and re-evaluated and expanded if necessary to address issues that are identified during the performance demonstrations.

Site contractors should also consider actions to improve the performance of IVRs. These suggested actions include periodic self-assessments of the overall IVR process to verify that IVR assessments are performed consistently by various performing organizations and to identify areas for improvement and lessons learned. Contractors should also review and consider revising the IVR procedure to ensure that the plans guiding the conduct of IVRs for major changes receive formal review and approval prior to performing the IVR.

#### **2.4 Site Office Processes for Oversight of Initial Verification of Safety Basis Hazard Controls**

**Statement:** DOE Guide 423.1-1, Appendix D, is intended for use by both DOE contractors and DOE organizations. The guide indicates that a DOE IVR, if performed, may be done as a standalone review or as part of oversight of the contractor process for achieving readiness, but does not directly address the decision-making process for determining when to do an independent review or shadow assessment. DOE Guide 226.1-2, which was issued in June 2012 near the end of the targeted reviews, contains additional detailed guidance related to Federal line management oversight of nuclear facilities, including a special emphasis on implementation of the safety basis.

**Discussion:** Site office oversight of the implementation of safety basis hazard controls is accomplished through a combination of methods including independent or shadow IVRs, readiness reviews, reviews of safety basis documentation, assessments, and routine oversight. Implementation of the new or revised safety basis documents is often the responsibility of the nuclear safety organization within the site office. Additionally, Facility Representative (FR) routine oversight includes implementation of safety basis hazard controls in administrative and operating procedures and work control documents, including oversight of contractor IVR activities at the facility.

All but two of the site offices have procedures and processes in place that govern oversight of safety basis implementation. The process is generally included in the safety basis oversight procedure and includes oversight of the contractor safety basis implementation, typically either an independent site office IVR or more commonly a shadow assessment of the contractor IVR. Independent Oversight identified that one site office had not provided a reasonable turnaround on the review of safety basis documents, resulting in delays in implementation of up-to-date hazard controls, and contributing to configuration control issues with the safety basis documents.

Only one site office was found to have routinely conducted independent IVRs for safety basis changes. Several site offices had conducted some independent IVRs, but others had not recently performed an independent IVR, and at least one site office had never conducted an independent IVR. Nearly all of the site offices had participated by shadowing some of the contractor IVRs, although in some cases, documentation of the shadow assessment was not available or not sufficiently detailed to determine the extent of the oversight activities or contractor performance (for example, when the shadow assessment was documented in routine reports such as FR weekly input). One site office had not conducted a shadow assessment of any recent contractor IVRs. None of the site offices had recently conducted an assessment of the contractors' IVR programs or processes, although one had conducted an assessment in 2007, and another had added the assessment to its fiscal year 2012 assessment schedule.

All site offices also have thorough, mature procedures governing the startup and restart of nuclear facilities, though several of the sites have not integrated the IVR as a preparatory activity for achieving readiness in the readiness review process (as allowed by the most recent versions of the applicable DOE order and standard).

**Analysis:** Site office oversight of the implementation of safety basis hazard controls is accomplished primarily through shadow assessments of contractor IVRs. All but two site offices have procedures and

processes governing oversight of safety basis implementation. The IVR process is generally included in the safety basis oversight procedure, and the process typically includes oversight of the contractor safety basis implementation. Nearly all of the site offices have participated to some extent by shadowing some of the contractor IVRs, but the site offices have not consistently conducted their own independent IVRs or evaluated the contractor IVR programs, and the documentation of shadow assessments in some cases is not sufficient to evaluate contractor performance.

**Recommended Actions:** In fulfilling their responsibilities for implementation and oversight of the IVR programs and processes at their facilities, DOE Headquarters program offices should promulgate clear expectations for DOE site office implementation of DOE Guide 226.1-2. The program offices should also provide specific expectations to the site offices for the use of DOE Guide 226.1-2 in determining when site offices should perform independent verifications, oversee contractor IVRs, and/or assess the contractor's IVR programs. Site offices should also review and revise the site office procedures, as necessary, to establish clear roles, responsibilities, authorities, and methods for implementation of site office IVR responsibilities.

DOE site offices should also establish expectations for site contractors to perform independent initial IVRs at their sites. Expectations for the contractor programs could be promulgated through contract requirements documents or performance incentives, and should encourage the contractor to establish and implement a functionally independent assessment element for IVR processes.

## **2.5 Site Office Processes for Oversight of Periodic Re-verification of Safety Basis Hazard Controls**

**Statement:** DOE Guide 423.1-1A states that DOE may choose to perform periodic re-verification of safety basis hazard controls as part of DOE's normal oversight efforts, which may not need to be as formal or detailed as the contractor re-verification. The guide further indicates that the approach to re-verification should be determined as part of DOE's integrated oversight planning. DOE Guide 226.1-2 provides additional, more detailed guidance on the scope, sample size, and periodicity of DOE field element activities relating to re-verification of existing safety basis hazard controls.

**Discussion:** Although several site offices do not specifically address re-verification of safety basis hazard controls in their procedures, Independent Oversight noted that most perform some re-verification activities through routine FR oversight and by reviews conducted by the safety system oversight (SSO) staff. Most of the National Nuclear Security Administration (NNSA) site offices had included the requirements from the office of the NNSA Administrator (NA-1) Supplemental Directive 226.1A (to perform at least one formal safety system assessment for safety class systems every three years, for safety significant systems every five years, and for important-to-safety systems as needed to ensure operability of safety systems) in the site contracts.

Site office oversight of the SSCs and design features is accomplished through a combination of methods including independent or shadow IVRs, readiness reviews, reviews of safety basis documentation, assessments, and routine oversight. Additionally, the SSO engineers provide oversight of active vital safety systems (and some include design features), and FRs routine oversight includes surveillances and maintenance activities for safety SSCs. At all of the sites, FRs perform daily oversight of facility operation, including reviewing the status of limiting conditions for operation, performing walkdowns of safety-related systems, observing surveillance tests, and participating in the review of safety basis documents, readiness reviews, and IVRs. For example, at one site, FR oversight of TSR implementation led to the identification of significant deficiencies related to the fire suppression system. The SSO program has also contributed significantly to the oversight of safety SSCs at a number of sites. At several sites, SSO personnel perform shadow assessments of contractor system engineer vital safety system

walkdown inspections and/or conduct independent assessments of vital safety system performance, including the ability of the SSCs to meet the safety functional requirements. The reports provided by the SSO staff at several site offices were found to be thorough and complete. One notable practice involved the tracking of the specific quarterly SSO assessments (including SSCs, design features, and SACs) in an internal database that provided a detailed record of completed assessments.

Site office oversight of SAC implementation is accomplished through a combination of methods including independent or shadow IVRs, readiness reviews, reviews of safety basis documentation, assessments, and routine oversight. It was noted that a number of the site offices had completed a review of SACs in 2009 using criteria and guidance provided by DOE Headquarters. One site office schedules reviews of the SACs at each of the nuclear facilities, such that all of the SACs are evaluated every three years.

Overall, formal oversight reports were well documented, providing adequate evidence of the methods and approaches used for the assessment and presenting sufficient detail to support the conclusions. Many of the reports provided evidence of the thorough, critical nature of the reviews; SSO reports at three sites were notable for their thoroughness. However, at several other site offices, reports were either not prepared to record oversight of IVRs or lacked sufficient detail to describe or support the conclusions.

**Analysis:** Most site offices perform re-verification activities through routine FR oversight and reviews conducted by the SSO engineers, although several site offices do not specifically address re-verification of safety basis hazard controls in their procedures. A number of the site offices have also completed formal reviews of SAC implementation. The SSO engineers primarily provide oversight of active vital safety systems and some include design features, and FRs monitor implementation of the facility TSRs. Although these activities are extensive, they do not systematically determine whether safety basis hazard controls remain in place or evaluate the contractor's IVR re-verification program.

**Recommended Actions:** DOE program offices should disseminate clear expectations for DOE site office re-verification of safety basis hazard controls at their facilities. Site offices should establish an expectation for periodic re-verification of a sample of safety basis hazard controls and then schedule these reviews in the site's annual oversight plans. A scheduling matrix that lists each TSR control (including vital safety systems and design features) might prove useful in monitoring the progress of the site office's re-verification activities.

Site offices should also clarify internal roles and oversight responsibilities to address coordination among the site office organizations and technical staff (for example, authorization basis team members, SSO engineers, and FRs) for oversight of contractor re-verification processes. Site offices should consider coordinated reviews of the contractor IVR programs and include a mix of independent IVRs, shadow assessments, and assessments of the contractor's IVR program (and similar programs) to support evaluation of the contractor assurance system.

Finally, site offices should consider steps to improve the documentation of FR oversight activities for safety basis hazard controls. For example, FRs should routinely document significant oversight activities even if the site processes do not normally require a formal oversight report. In particular, site offices should ensure that assessment activity reports consistently document and communicate the scope, criteria, activities performed, issues identified, and overall results of the oversight activity for safety basis hazard controls.

## 2.6 Site Office Performance of IVRs or Similar Activities

**Statement:** DOE Guide 423.1-1 provides guidance for planning and conducting IVRs, including instructions for development of formal IVR plans; selection of team leaders and team members; and detailed methods for verifying design features, safety systems, and procedures. The guide also provides examples of forms that may be used to document the results of the IVR.

**Discussion:** Independent Oversight observed the performance of three readiness reviews that involved verification of implementation of safety basis hazard controls by DOE site offices, as well as ongoing oversight activities. Although the readiness reviews were not specifically IVRs, observation of the readiness reviews provided information regarding verification processes for the implementation of safety basis hazard controls. One of the reviews involved a contractor readiness assessment in which the DOE site office combined a shadow review of the contractor's readiness assessment with an independent assessment of some functional areas. The second review involved a DOE readiness assessment for startup of activities at a facility that involved implementation of new safety basis hazard controls. Finally, Independent Oversight observed the conduct of a DOE ORR for the startup of a new waste treatment facility.

Both of the readiness assessments were conducted using implementation plans that contained adequate scopes for the reviews. These reviews were conducted in accordance with approved implementation plans that adequately fulfilled the scope and breadth of the DOE plan of action (which appropriately addressed implementation of safety basis hazard controls), and either shadowed or followed a contractor readiness assessment. The reviews appropriately used a set of CRADs or lines of inquiry to guide the assessment, and included document reviews, interviews, facility walkdowns, and observation of performance demonstrations. Overall, the review team members were sufficiently independent of responsible DOE line management and had adequate technical expertise and qualifications for their assignments. During the shadow review, the site office team placed sufficient emphasis on observation of the assessment and interacted sufficiently with the contractor's readiness assessment team members to ensure that potential issues were addressed and resolved. The degree of rigor applied to the readiness assessments was appropriate. Team members closely observed the performance demonstrations and conducted probing interviews, posing questions that were appropriate to the topical areas. Team members appropriately followed up on potential issues. Notably, during one assessment, the team developed two scenarios for off-normal events, one of which was injected without advance notice during the performance demonstrations. The final reports adequately documented the teams' activities and supported their conclusions, which, in one case, included a finding in addition to those identified by the contractor's readiness assessment team. Overall, the DOE readiness assessment teams adequately executed their implementation plans and provided critical assessments of the previous reviews and the contractors' readiness to implement the safety basis hazard controls.

For the DOE ORR, the site office used a certification and verification plan to document the planning and actions taken to verify both site office and contractor readiness to proceed. The certification and verification plan included a description of the DOE oversight processes, and provided a good description of the oversight process and basis for readiness. The ORR team conducted their review in accordance with an approved plan of action and implementation plan. The plan of action adequately addressed the relevant requirements to comply with DOE Order 425.1D, including safety basis hazard control implementation. The implementation plan included the scope and depth of the review, prerequisites, review approach, and an appendix with the CRADs for each functional area. The implementation plan tailored the breadth and depth to take into consideration recent independent reviews, including the results of the contractor ORR. The implementation plan allowed the possibility that not all systems would be demonstrated due to potential time constraints, but did not specify how these systems would eventually be assessed. The DOE ORR team members, including the team leader, deputy team leader, team

coordinator, and subject matter experts, were very experienced and included a number of members with previous readiness review experience. The DOE ORR schedule included a significant number of performance demonstrations. A single surveillance test (for one of the safety-significant instrumentation systems) was scheduled; however, the performance of the surveillance was terminated at an early stage. Overall, the DOE ORR was executed per the implementation plan, and the team members were well prepared to evaluate the significant number of performance demonstrations and evolutions. The degree of rigor applied to the DOE ORR was appropriate for the initial startup of a one-of-a-kind process, and the results are properly documented in both a detailed brief and final report. The findings and recommendations are well documented, and designation of findings is adequately justified. However, the DOE ORR team did not observe an appropriate sample of the surveillance tests required to demonstrate operation of the facility within the safety basis hazard controls.

Independent Oversight observed site office personnel as they performed oversight, interviewed personnel, reviewed training and qualification materials, and reviewed assessments and reports to determine if site office personnel are sufficiently trained and knowledgeable to provide oversight of safety basis hazard control implementation. In all cases, the FRs and SSOs had completed the appropriate technical qualification program as demonstrated by completed qualification cards and examinations. In general, the FRs had numerous years of experience related to nuclear safety oversight. The FRs were knowledgeable of their facilities, as was demonstrated by walkthroughs and interviews, and most FRs participate as team members on the safety basis review teams for their respective facilities. Tours of the facilities clearly indicated that the FRs and SSOs were knowledgeable of the operations and conditions in their facilities, and were knowledgeable of the safety basis hazard controls and safety SSCs. During the DOE-led formal reviews, the DOE teams were found to be well qualified and experienced, conducted the assessments in accordance with established plans, applied an appropriate degree of rigor, and were thorough in their approach and follow-up on potential issues.

**Analysis:** All of the site office readiness reviews observed by Independent Oversight used adequate implementation plans with appropriate sets of criteria or lines of inquiry for verifying implementation of the safety basis hazard controls. The review team members were sufficiently independent of responsible DOE line management and had adequate technical expertise for their assignments. With one exception, the teams placed sufficient emphasis on observations of performance. Overall, the DOE readiness review teams adequately executed their implementation plans and provided critical assessments of the previous reviews, but in one case, the DOE review team did not observe an appropriate sample of surveillance tests.

**Recommended Actions:** DOE teams conducting readiness reviews should emphasize and expand the use of performance demonstrations to evaluate not only readiness to operate but also readiness to implement safety basis hazard controls. Implementation plans and pre-planning activities for the reviews should include a representative number of performance demonstrations for activities that implement safety basis hazard controls. When sampling is used as part of the review, the teams should evaluate the scope of the sample, including performance demonstrations, and expand it if necessary to ensure that previously identified issues have been appropriately resolved.

### 3.0 NOTEWORTHY PRACTICES

IVR implementation practices that were found to be especially effective at one or more DOE sites are described below. This information may be useful to sites that are working to improve the effectiveness of their IVR programs. Independent Oversight recognizes that the information below is derived from a sample of DOE sites and that other sites may also have effective, innovative approaches to IVR implementation.

### **3.1 Periodic Re-verification**

A few site contractors (Pantex Plant, Nevada National Security Site, Hanford Site, and Y-12 National Security Complex or Y-12) have formally established procedures or processes to re-verify the implementation of safety basis hazard controls. The approach at one site (Pantex Plant) has been to re-verify 20 percent of all safety basis hazard controls, addressing SSCs, SACs, and design features, annually with a goal of completing the re-verifications over a five-year period. The process is well managed, and the resulting management self-assessments are well documented. Another site (Y-12) has established a goal to re-baseline the safety basis hazard controls at a facility every three to five years (based on the assessed risk of the facility) through conduct of an IVR. A third site (Hanford Site) has established requirements for periodic re-verification of TSRs and SAC implementation, which are to be implemented by the facility line management organizations and overseen by the central functional area manager. Each of these approaches provides a noteworthy method to achieve periodic re-verification of safety basis hazard control implementation at the site's nuclear facilities.

### **3.2 Verification and Re-verification by Functionally Independent Groups**

Although most sites establish some degree of independence for the IVR reviewers, several site contractors (Pantex Plant, Nevada National Security Site, Y-12, Los Alamos National Laboratory, and Oak Ridge National Laboratory) use functionally independent groups (i.e., reporting to a senior manager and independent from the line management responsible for the facility) to complete initial and periodic IVR reviews and to provide internal self-assessments of the IVR processes. By using both internal and external personnel, these groups bring a fresh perspective and a critical approach to the review of the safety basis hazard implementation, and routinely identify issues and weaknesses in the facilities' safety basis implementation processes. Evidence gathered during this review supports the conclusion that the conduct of IVRs by independent groups is effective in improving the implementation of safety basis hazard controls and should be considered as an integral part of a site's IVR program.

### **3.3 Use of Performance Demonstrations**

IVRs are enhanced by observing operations and evolutions, conducting facility walkthroughs, using tabletop interviews, and observing operational drills whenever possible. During the DOE readiness assessment at Building 3019 at the Oak Ridge National Laboratory, the team developed and planned two scenarios for off-normal events, one of which was injected without advance notice during the performance demonstrations. During an IVR at Y-12, the reviewers developed a performance demonstration to be conducted during a facility walkthrough. Both of these activities were effective in evaluating the procedures and the training on the safety basis changes.

### **3.4 IVR Requirements Included in Site Contracts or Other Site Documents**

Several site offices have enhanced the understanding of the requirements for IVRs, both initial and periodic, by including the requirements in the management and operating contract or by incorporating the requirements through site-specific mechanisms. Two site offices (Y-12 Field Office and Nevada Field Office) have included a requirement for the contractor to develop and implement an IVR process to validate the implementation of all significant changes to safety basis documentation in the requirements of the site contract. A third site office (Idaho Operations Office) has included the requirement to verify that applicable limits and controls are implemented in operating procedures or other approved documents as a TSR surveillance requirement. Each of these mechanisms provides additional clarity to the expectations for the site contractors to establish and execute an IVR process.

### **3.5 Tracking Performance of IVR Activities**

One site office (Savannah River Field Office) has developed a matrix that provides an excellent means of tracking the performance of IVR activities and ensuring each safety basis hazard control is periodically re-verified. The matrix includes all of the TSRs, SACs, and design features, and provides a ready visual aid to track completion of periodic evaluations and to determine the status of re-verification for each safety basis hazard control. The matrix provides a positive means of ensuring that the safety basis hazard controls receive a periodic re-verification.

## **Appendix A Recommended Actions**

The recommended actions discussed below are based on lessons learned during the Independent Oversight reviews. While the underlying deficiencies and weaknesses did not necessarily apply to all of the sites and many sites have developed and implemented actions for the issues identified at their sites, the recommended actions provide additional insights into potential improvements at all sites. Consequently, DOE organizations and site contractors should evaluate the applicability of the following recommended actions to their operations and consider their use as appropriate in accordance with site-specific program objectives.

### **DOE, including NNSA, Headquarters Program Offices**

- 1. Establish formal expectations for site offices and contractors to perform initial IVRs and periodic re-verification of safety basis hazard controls.** DOE Guide 226.1-2, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, issued in June 2012, includes guidance for DOE line management oversight of TSR implementation and safety system operability. Although this DOE Guide had not been issued when Independent Oversight began its reviews of IVR programs, it is an additional resource for Federal line management. Specific actions to consider include:
  - Clarify program office expectations for DOE site office implementation of DOE Guide 226.1-2 in fulfilling site office responsibilities for implementation of safety basis hazard controls, including oversight of initial IVRs, periodic re-verification programs, and similar processes at their facilities.
  - Provide specific expectations for determining when site offices should perform independent verifications, shadow contractor IVRs, and/or assess the contractor's IVR programs.
  - Address the periodic re-verification of safety basis hazard controls, including design features, either through systematic evaluation over a given time period or periodic re-baselines of the controls.
  - Ensure that the IVR process is given sufficient emphasis to achieve full verification of implementation when IVRs are implemented as part of the readiness assessment process.
  - Promulgate the expectations for IVRs (using the guidance in DOE Guides 226.1-2 and 423.1-1A, as appropriate) to the contractors more formally in order to establish firm expectations and standards for implementing the programs and processes, such as use of a full IVR as preparation for a readiness review.

### **DOE Site Offices**

- 1. Establish expectations for conducting independent initial IVRs.** Specific actions to consider include:
  - Through contract requirements documents or performance incentives, encourage the contractor to establish and implement a functionally independent assessment element for IVR processes.
  - Revise the site office procedures to establish clear roles, responsibilities, authorities, and methods for implementation of site office IVR responsibilities.

- Following the guidance in DOE Guide 226.1-2, clarify expectations for site office performance of independent IVRs (i.e., in addition to shadowing, conduct IVRs independent of the contractor) and for site office assessments of the contractor IVR process to ensure that the system remains effective.
  - Establish criteria to guide the decision on whether to conduct an independent DOE IVR or shadow the contractor IVR, and a process to document the rationale for the decision.
  - Provide guidance for determining whether a shadow assessment should be performed as a formal team assessment rather than as an informal operational assessment for more significant hazard control changes.
- 2. Establish expectations for conducting re-verification of safety basis hazard controls. Specific actions to consider include:**
- Leverage the activities of existing programs and clarify expectations for periodically re-verifying safety basis hazard controls (using the guidance in DOE Guide 226.1-2). Consider, for example:
    - Increasing the depth and scope of SSO reviews to include verification that surveillance tests of safety systems and components continue to demonstrate operability of the hazard controls
    - Defining how oversight of the contractor’s system engineering program and oversight of vital safety system configuration management support hazard control re-verification
    - Adding sufficient detail to FR reports so that implementation verification activities are readily identifiable
    - Including periodic verification of SAC implementation
    - Adding assessments in the nuclear facility safety topical area, such as TSR implementation and design control
    - Developing a scheduling matrix that lists each TSR control (including vital safety systems and design features) and includes past verifications and planned verifications
    - Including periodic verification that design features are being appropriately inspected and tested.
  - Establish an expectation for periodic re-verification of a sample of safety basis hazard controls and then schedule these reviews in the site’s annual oversight plan.
- 3. Emphasize and expand the use of performance demonstrations to evaluate implementation of safety basis hazard controls. Specific actions to consider include:**
- Ensure that the implementation plans and pre-planning activities for the reviews include a representative number of performance demonstrations, planned demonstrations, tabletop interviews, and field walkdowns for operating procedures, surveillance tests, and in-service inspections that implement safety basis hazard controls.
  - When sampling is used as part of the review, ensure that the scope of the sample is re-evaluated and expanded, if necessary, when issues are identified during the performance demonstrations.
  - Ensure that the sample in the implementation plan is sufficient to verify that weaknesses and deficiencies identified during previous reviews, such as management self-assessments and contractor readiness reviews, are properly closed and that extent-of-condition reviews and corrective actions were effective.

4. **Conduct coordinated reviews of the contractor IVR programs.** Specific actions to consider include:
  - Periodically conduct independent IVRs, shadow assessments, and assessments of the contractor's IVR program to support evaluation of the contractor assurance system.
  - Clarify site office roles and responsibilities for oversight to address coordination among the site office organizations and technical staff (for example, authorization basis team members, SSO engineers, and FRs) and leverage existing activities in conducting oversight of contractor IVRs and similar processes.
5. **Include periodic verification that design features are being appropriately inspected and tested in site office oversight activities.**
6. **Improve documentation of FR oversight activities for safety basis hazard controls.** Specific actions to consider include:
  - Routinely document significant oversight activities even if the site processes do not normally require a formal oversight report.
  - Ensure that assessment activity reports consistently document and communicate the scope, criteria, activities performed, issues identified, and overall results of the oversight activity.
  - Consider providing additional guidance and formal management review and feedback to the technical staff to improve the quality and content of operational awareness reports.
  - Conduct quality reviews (i.e., using a formal checklist of criteria) of some operational awareness reports focusing on the content and quality of reporting.

#### **Site Contractors**

1. **Emphasize and expand the use of performance demonstrations to evaluate implementation of safety basis hazard controls.** Specific actions to consider include:
  - Ensure that the implementation plans and pre-planning activities for the reviews include a representative number of performance demonstrations, planned demonstrations, tabletop interviews, and field walkdowns for operating procedures, surveillance tests, and in-service inspections that implement safety basis hazard controls.
  - When sampling is used as part of the review, ensure that the scope of the sample is re-evaluated and expanded, if necessary, when issues are identified during the performance demonstrations.
  - Ensure that the sample in the implementation plan is sufficient to verify that weaknesses and deficiencies identified during previous reviews, such as management self-assessments, are properly closed and that extent-of-condition reviews and corrective actions were effective.
2. **Expand the use of independent reviewers in conducting IVRs.** Specific actions to consider include:
  - Evaluate the need to include an element of independent review in contractor IVRs or IVR-like processes in accordance with 10 CFR 830 quality assurance requirements.

- When independent reviews are optional, periodically conduct a self-assessment to determine whether independent reviews are being conducted when appropriate.
  - Establish a requirement to conduct a functionally independent review of all significant safety basis hazard control changes.
- 3. Improve the scheduling and performance of independent verifications and re-verifications.** Based on observation of good practices and weaknesses during the review, specific actions to evaluate for applicability to the site and to consider for implementation include:
- Evaluate the scheduling, tracking, and re-scheduling of independent implementation reviews to ensure that reviews are accomplished as scheduled.
  - Develop and implement an overall schedule for the periodic re-verification that SSCs, design features, and SACs continue to perform their safety functions.
  - Formally track and report the status of re-verification to improve awareness of safety basis hazard control re-verification efforts, and ensure that expectations are met.
  - Establish and execute a structured process for assessments and IVR activities to periodically re-baseline the safety basis hazard controls; use a formal matrix of credited SACs, limiting conditions for operation, and TSRs to guide the re-baseline process.
- 4. Take actions to improve the performance of IVRs.** Based on observation of good practices and weaknesses during the review, specific actions to evaluate for applicability to the site and to consider for implementation include:
- Perform a self-assessment of the overall IVR process to verify the consistency of the IVR assessments performed by various organizations and to identify areas for improvement and lessons learned.
  - Consider revising the IVR procedure to ensure that the plans guiding the conduct of IVRs for major changes receive formal review and approval prior to performing the IVR.
  - When some controls are not verified during an IVR (for example, when a system is out of service or not required for the anticipated operations), ensure that internal processes track the controls that were not verified, and conduct the independent verification prior to their implementation.
  - When the safety basis implementation plan serves as the basis for the IVR implementation plan, include a line of inquiry to verify the accuracy of the entries in the safety basis implementation plan.
  - Review completed IVR checklists periodically, and provide feedback to the reviewers to ensure that the documented activities sufficiently support the IVR conclusions.

**Appendix B  
Supplemental Information**

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## **Appendix C References**

### **IVR Review Reports**

- Independent Oversight Review of the Oak Ridge National Laboratory High Flux Isotope Reactor Implementation Verification Review Processes, January 2013
- Review of the Hanford Site CH2M Hill Plateau Remediation Company Implementation Verification Review Processes, November 2012
- Review of the Richland Operations Office Oversight of Implementation Verification Review Processes, November 2012
- Review of the Los Alamos National Laboratory Implementation Verification Review at Technical Area-55, July 2012
- Review of the Y-12 Implementation Verification Review Processes, June 2012
- Review of the Savannah River Site Tritium Facilities Implementation Verification Review Processes, June 2012
- Review of the Sodium Bearing Waste Treatment Project - Integrated Waste Treatment Unit Federal Operational Readiness Review, June 2012
- Review of the Sodium Bearing Waste Treatment Project - Integrated Waste Treatment Unit Contractor Operational Readiness Review, June 2012
- Review of the Nevada National Security Site Implementation Verification Review Processes, March 2012
- Review of the Implementation Verification Review Processes at the Oak Ridge Office of Environmental Management for Building 3019, February 2012
- Review of the Pantex Plant Implementation Verification Review Processes, February 2012
- Follow-up Review of Implementation Verification Reviews at the Savannah River National Laboratory Savannah River Site, January 2012
- Review of Implementation Verification Review Processes at the Idaho Site - Phase 1 of 2, November 2011
- Review of the Argonne National Laboratory Alpha-Gamma Hot Cell Facility Readiness Assessment (Implementation Verification Review Sections), November 2011
- Review of the Implementation Verification Review Processes at the Savannah River Site Environmental Management Nuclear Facilities, September 2011